Remarks / Arguments

This response is filed within the extension period for responding to the Office Action. A Request for an Extension of time is attached hereto.

Prior Art Cited by the Examiner

In the Office Action, the Examiner made reference to 1 document:

Document	Date	Inventor
US-6,188,066	August 1999	Whitehouse et al.

Amendments to the Claims

Claim 1 has been amended to more precisely claim the present invention. The limitations previously set out in dependent claim 5 have been incorporated into claim 1.

Claim 1 as amended relates to a method of injecting at least a portion of stream of ions into an ion processing section, wherein the stream of ions includes at least a first group on ions with a first charge state and a second group of ions with a second charge state. At least some of the injected ions are trapped in an ion processing section in an axial direction, thereby preventing the ions from escaping from the ion processing section by traveling in the axial direction of the ion processing section. The trapped ions are then thermalized. An energy barrier is provided in the ion processing section with a magnitude that is constant for a separation time period. During the separation time period, the energy barrier presents a first effective barrier to the first group of ions and a second effective barrier height to the second group of ions. Ions in the first group have a kinetic energy exceeding the first effective barrier height and preferentially escape from the ion processing section. Ions in the second group have a kinetic smaller than the second effective barrier height and remain preferentially trapped in the linear ion trap.

Support for the limitation that the magnitude of the energy barrier is at constant for a separation time period is found in the application as filed in paragraph 45 on page 10 and in Figure 4, with reference to the separation or partial emptying period 80.

Claims 2 and 3 have been amended to bring their language into alignment with that of amended claim 1.

Claim 24 is newly added and is dependent on claim 1. Claim 24 sets out the limitation that the length of the separation time period is between 1 to 50 ms. Support for this limitation may be found in the description in paragraph 47 on page 11.

Claim Rejections – 35 USC § 102

The Examiner objected to claim 1 as previously amended on the basis of Whitehouse.

Whitehouse discloses a conventional linear ion trap, which prevents ions from escaping from the ion trap in an axial direction (thereby establishing the linear nature of the ion trap), but permits the ions to travel in an axial direction. See column 3, lines 56-61 (which was referred to by the Examiner), where Whitehouse states that "[i]f an ion with a give mass to charge ratio falls within the operation stability region set for a multipole ion guide, the ion will be effectively trapped from drifting to [sic] far in the off axis direction, but is free to move in the direction of [the] ion guide axis".

In contrast, the trapping step of claim 1 provides that the injected ions in the ion processing section are trapped in an axial direction.

The Examiner also referred to column 4, lines 10-14 of Whitehouse, where Whitehouse explains that the DC offset potential on the poles in a multipole ion guide can be used to set the energy of ions transmitted through the multipole ion guide. This is a standard and conventional aspect of multipole ion guides. The DC offset affects the radial stability of ions in the multipole, affecting which ions are able to escape radially from the ion guide, but does not relate to whether ions are able to escape in an axial direction. The method of the present invention is compatible with the use of this conventional technique of applying a DC offset to the poles of a multipole ion guide, but this technique is not the subject of the invention described in claim 1, which relates to trapping ions in a linear ion trap, in an axial direction.

The Examiner also referred to column 13, lines 9-49 of Whitehouse, which describe the conventional technique of thermalizing the ions traversing the length of an ion guide. As ions are mass scanned through the ion guide, they are simultaneously thermalized by causing them to collide with a background gas. Whitehouse notes, at lines 15-17 that the radial movement of ions is restricted, but specifically describes that the ions "travel the length of the ion guide" (line 23). In contrast, the method of the present invention provides that the ions are trapped in an axial direction during the thermalizing step.

The Examiner referred to column 19, lines 24-28 and column 20, lines 19-33 of Whitehouse, where Whitehouse describes a multipole ion guide that extends through a three stage vacuum pump and the trapping efficiency of his ion trap system. The Examiner indicates that this section is relevant to claim 5 as previously on file. The Applicant does not understand the relevance. The previous claim 5, which has been cancelled and the limitations of which are now included in claim 1 do not relate to a multi-stage vacuum pumping stage and do not relate to the efficiency of the linear ion trap of the present invention, but relate instead to injecting a stream of ions in the linear ion trap for an injection period.

The Examiner also referred generally to column 5, lines 45-50 of Whitehouse, but cited that section discussed above at column 13, lines 9-49. The Applicant believes that the Examiner must have been referring to the section in column 13, which is not relevant to claim 1 for the reasons discussed above.

None of the section cited by the Examiner in reference to claim 1 as amended anticipate claim 1. In fact, Whitehouse does not describe any mechanism or method for axially trapping ions in a linear ion trap and then preferentially allowing ions with one charge

state to escape from the ion trap while preferentially continuing to trap ions with a second charge state, either in the sections cited by the Examiner or anywhere else.

The Applicant respectfully submits that claim 1 is patentable over Whitehouse. Similarly, all of the claims depending on claim 1 are patentable for the same reasons as claim 1.

The Examiner rejected claims 6, 11-14 and 22 and referred to several sections of Whitehouse, each of which is discussed below. Each of these claims is dependent on claim 1 and includes the limitations thereof.

The Examiner referred to column 4, lines 16-21 of Whitehouse where Whitehouse states that a multipole ion guide can be used to deliver an ion beam with a low energy spread to a mass analyzer. Whitehouse's method for doing so is described at column 9, lines 9-49, where Whitehouse describes a conventional technique for thermalizing ions as they traverse the length of an ion guide. Whitehouse does not describe, suggest or contemplate thermalizing ions while they are axially trapped in a liner ion guide.

The Examiner also referred to columns 7, lines 57-63 and column 8, lines 18-33, which describe the use of an ion guide to provide ions to a mass analysis or mass filter stage. The present invention is directed to analyzing ions to distinguish between groups of ions with different charge states, in a linear ion trap. The groups of ions may be mass analyzed after they have been separated. These sections of Whitehouse do not describe the analysis of an ion stream to enhance the separation of groups of ions with different charge states.

The Examiner objected to claims 15-21 and 23 with reference to several sections of Whitehouse, each of which is discussed below. Each of these claims is dependent on claim 1 and includes the limitations thereof.

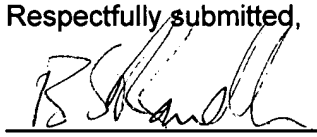
The Examiner referred to column 8, lines 37-44, which refers to collisional induced dissociation (CID) fragmentation of ions. The Examiner referred to column 10, lines 33-42, which describe mapping the ion transmission characteristics of a multipole lens based on the m/z of ions of interest. The Examiner referred to column 17, lines 24-36, which relate to configuring a multipole ion guide to pass a narrower range of m/z. The Examiner also referred to column 17, lines 46-62, which also relates to configuring an instrument to allow distinction of ions based on m/z. None of these sections relates to the invention of claim 1.

In summary, Whitehouse does not describe a method for axially trapping ions in a linear ion trap, thermalizing the trapped ions and then providing an energy barrier with a magnitude that is constant for a separation time period to allow a first group of ions with a first charge state to preferentially escape from the ion trap.

Conclusion

In view of the foregoing comments, it is respectfully submitted that the application is now in condition for allowance. If the Examiner has any further concerns regarding the language of the claims or the applicability of the prior art, the Examiner is respectfully requested to contact the undersigned at 416-957-1630.

Respectfully submitted,



Bhupinder Randhawa, Reg'n No. 47,276
Bereskin & Parr, Customer No. 001059